Research FOR FARMERS

FALL - 1956

In a study of mechanical or "zero" grazing at the Central Experimental Farm, Ottawa, the forage harvester delivers the cut grass directly into the mobile self-feeder which is then hauled to the feed lot. (See outside back cover.)

CANADA DEPARTMENT OF AGRICULTURE

Research FOR FARMERS

CANADA DEPARTMENT OF AGRICULTURE
Ottawa, Ontario

Rt. Hon. JAMES G. GARDINER, *Minister*
J. G. TAGGART, C.B.E., *Deputy Minister*

NOTES AND COMMENTS

Of all the plant species growing in Canada one in five rates as a weed. The annual weed cost runs into hundreds of millions, enough to warrant close attention to their control. On page 6 Dr. Frankton touches on the need for proper identification as a requisite for successful attack against the enemy. Frankton is author of the excellent manual published by the Department under the title "Weeds of Canada", sold by the Queen's Printer.

* * *

Following a late wet season over much of the country growers have reason to be well aware of the importance of late blight of potatoes. Authors Young and Howatt on page 3 tell of the efforts being made to meet the threat of blight by developing resistant varieties. Mr. Young is horticulturist at the Fredericton Experimental Farm while Mr. Howatt is a pathologist at the Plant Pathology Laboratory, Fredericton.

* * *

Consumers eating habits often have a profound effect on the farm economy. Food fads often stimulate demand for one product while killing the market for another. Charlotte Johnston of the Economics Division reports on page 10 the results of a study on consumer preferences and reactions to specially selected side bacon. The study involved the co-operation of the Department's Home Economists, Meat Grading Staff, and Economists, as well as meat packers and retailers.

* * *

Economics will probably determine the future of the so-called zero grazing practice now attracting considerable attention. Our cover picture illustrates one type of equipment in use and a short article on page 16 by V. S. Logan, dairy cattle research man at the Central Experimental Farm, Ottawa, comments on preliminary results of trials.

* * *

How often it happens that no sooner is one problem solved than another is on the doorstep. Wheat stem sawfly is a case in point. In the "dirty thirties" researchers seeking to conquer soil drifting developed the strip farming technique. It held the soil but provided ideal conditions for the sawfly to multiply and become a major pest. But science has come to the rescue with resistant varieties, first of which was appropriately named "Rescue". Dr. Holmes, whose article appears on page 13, summarizes the known facts in connection with sawfly control and explains some of the problems still to be solved. Holmes is an entomologist at the Lethbridge, Alta., Laboratory.

FALL - 1956

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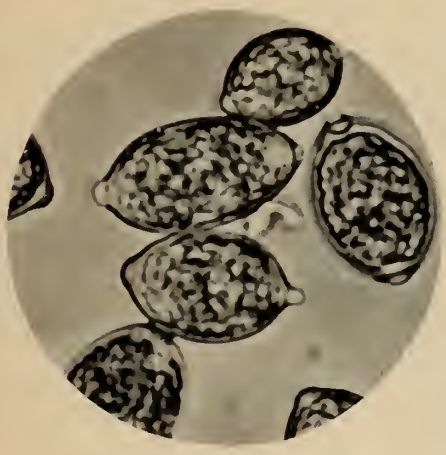
"*Research for Farmers*" is published quarterly by the Canada Department of Agriculture. Its purpose is to help keep extension workers informed of developments in research and experimentation as carried on by the various units of the Department.

* This is the last number of Volume 1.

Left: Healthy field of pototoes.

Below: Lote blight infected pototo field. Close-up of organism encircled ot left.



CAN WE CONQUER LATE BLIGHT?

L. C. Young AND *J. L. Howatt*

SPORADIC ravager of potato crops from Newfoundland to British Columbia, late blight may be of local or regional importance. In areas where late blight is common and destructive, the application of fungicidal sprays or dusts as a means of control is a regular cultural practice. Ordinarily such treatment is effective. However, in epidemic years the application of eight to ten sprays often fails to control the disease and heavy losses result from premature destruction of the foliage and rotting of the tubers. Uncertainty and high costs attending this method of control have sparked a search for resistant varieties. Therein may lie the solution of the problem.

In Canada breeding for late blight resistance began in 1934 at Fredericton, N.B., as a co-operative project between the Experimental Farm and the Plant Pathology Laboratory. An isolation station in a coastal region of the province is operated solely for the purpose of maintaining and multiplying seedling stocks in a disease-free condition.

Source of Parental Material

Earlier methods of potato improvement were concerned mainly with the yielding ability and culinary quality of the crop, and little attention was paid to the disease problem. The breeding of varieties capable of withstanding disease attacks was hampered by lack of resistant parental material.

Comporotive pototo yields from blight infected plot (left) ond healthy plot (right). Yields illustrated were obtained from experimentol plots and not fields shown obove.

Efforts to widen the source of useful parental material began in 1925. Potato collecting expeditions from several countries of the world were sent to Mexico and South America. There, numerous hitherto unknown wild and cultivated potato species, possessing a wide range of highly desirable characteristics, including blight resistance, were found. One of the wild species from Mexico, *Solanum demissum* Lindl., has since been used extensively in the breeding programs of Europe and America. While it has served as the source of resistance in most original crosses, it has many undesirable features including special day-length requirements, very long stolons, tiny tubers with a bitter flavor, and prostrate vines. Moreover, it can be used only as the female parent, and this characteristic has persisted to a marked degree in succeeding generations, thus greatly handicapping the program. This was all the more serious since many common commercial varieties also make poor pollen parents.

Plant breeder showing seed balls—result of controlled pollination of the potato flower (left inset). New varieties originate from true seed contained in the seed ball (right inset).

Selection Method

At Fredericton the general procedure has been to cross *Solanum demissum* with standard varieties of the cultivated species *Solanum tuberosum* and then to backcross the resulting progenies for several generations to similar varieties, always selecting on the basis of blight resistance and a general improvement in plant characters. Each generation required a time lapse of two to three years to make the cross and assess the progeny. Since four to six successive crosses were required to produce seedlings with satisfactory agronomic characteristics, it is evident that a period of ten to fifteen years is required to produce satisfactory new varieties.

In spite of the tedious and time-consuming nature of the program, marked progress was made in combining blight resistance with desirable plant characters. More than 124,000 seedlings were produced in this effort, and eventually two varieties, Keswick and Canso, were named and introduced in 1951. These varieties in the field were immune to late blight, and could be grown without any form of fungicidal protection. The objective appeared to have been reached, at least in part.

New Races Appear

The triumph, however, was short-lived. Shortly after this, these varieties and other resistant hybrids were found to be succumbing to late blight in various localities. Further research revealed the sudden appearance of new physiologic races of the blight organism to which these varieties were not resistant. It was hoped at first that a variety containing four resistant factors or genes would solve the blight problem, because at that time, race (1, 2, 3, 4) was hypothetical. The discovery of this form in 1953 greatly complicated the problem and necessitated the search for a fifth gene conferring resistance. This was found in some of the original parental material used in the Fredericton program as well

Test plots (lower) on the Almo, N.B., potato-breeding substation (right) where potato seedling stocks are maintained and multiplied in a disease-free condition.

as in introductions from other sources. The more recent discovery of still another race suggests the necessity of at least a sixth gene if complete resistance is to be obtained. No variety has as yet been introduced in any country that has not proved susceptible to at least one of the now-existing forms of the late blight organism. Whether these new forms arise by mutation, or whether they are already present in the form of a mixture, is not known. Whatever the answer their presence is revealed only when suitable host plants are developed. Fifteen races have been identified already, and probably this number will be increased in the future.

Surveys conducted in recent years show that thirteen of these blight races are present in potato fields in Canada. The greatest number of races is found in Eastern Canada where even the highly specialized race (1, 2, 3, 4) occurs in the field.

Resistant Material Essential

At the present time the prospects of securing permanent blight resistance are remote because of the ever-changing picture regarding races of late blight. Our hope is to keep in advance of the fungus by producing resistant varieties. Whether or not a new variety will succumb in the field will depend entirely upon the forms of blight prevalent in any given area. Unfortunately, the non-existence of a given race in a given area is no guarantee that the race will not turn up unexpectedly. However, until the complete range of resistance of *Solanum demissum* has been incorporated into the domestic potato, we will not know definitely the full possibilities from this source. Furthermore, preliminary work has indicated the superiority of the resistance in other wild species. Herein may be the hope for the future.

Results of 1956 Processing Pea Trials

Promising new varieties of peas selected for further testing at the Smithfield, Ont., Substation show little variation in the yield of shelled peas. L. H. Lyall, vegetable specialist with the Horticulture Division of the Experimental Farms Service, points out that in these Advanced Yield Trials 6 selected varieties are grown each year in 50 × 15 ft. plots each replicated five times. Maturity is determined by the texture meter. The vines are cut by hand, put through a half-size viner and yields recorded. Results of the 1956 trials are shown in the following table:

Differences between varieties of comparable season were not great. Growth was irregular in most varieties because of dry weather during June. The variety Mammoth Early Canner made exceptional vine growth for an early variety but gave a low yield of shelled peas. Kelvedon Monarch, a new English variety of the Perfection plant type was a heavy yielder of dark green peas. This variety shows some promise as a freezer.

Variety	Per cent germination	Texture at harvest	Days seeding to harvest	Yield Vines (tons/ac)	Yield Shelled peas (lb./ac)
Loyalty	71	84	67	9.4	3694
Kelvedon Monarch	61	84	71	9.7	3578
Early Perfection 109	69	91	68	9.6	3450
Cascade	70	86	72	11.1	3334
Selkirk	67	85	71	8·1	3229
Mammoth Early Canner	88	87	62	8.9	2021

Globe thistle.

WEEDS

We Need to Know More About Them

C. Frankton

MANY a bad weed has gained a foothold simply because it wasn't recognized for what it was. Success in weed control depends largely on a proper understanding of the weeds we're trying to destroy. Because most of our weeds have been introduced it is often difficult to trace them down by means of North American floras. Frequently, careful search in foreign literature, particularly European and Asiatic, is required before a strange plant can be identified.

Here is a case in point. Between 1949 and 1953 battered fragments of a puzzling catchfly were sent to our laboratory from three different points in Saskatchewan. Unfortunately, none of these specimens was good enough to permit precise identification although it was early established that the species was not included in our floras or even in the North American monograph on the group. It was thought to be of Asiatic origin and when a more complete specimen was received in 1954 it was possible to utilize a Russian flora and identify the specimen as *Silene sibirica* a plant not previously reported for North America.

Weed workers may consider correct identification of weeds a trivial matter but there is a definite practical application. Certainly some of the confusion as to what weeds are controllable, and to what degree, is attributable in part to misidentification. An early report from the United States claimed that field bindweed could be controlled readily by 2,4-D; subsequently it was found that the bindweed controlled was one of the annual species. An introduced plant, halogeton, poisonous to livestock, now occupies some 4 million acres in the Western States and this abundance may well be due to the fact that it was at first confused with Russian thistle and had become well established before being recognized as a serious menace.

In recent years many problems in weed identification have been solved at our Laboratory. We now know that hoary cress in Canada really consists of three distinct varieties differing in field performance to such an extent that each will probably require a different control program. Wild oats have been studied intensively and four varieties are known to occur in Canada. The weed-control specialist may well have to consider these varieties in his research as they appear to differ in field performance and in the number of seeds that remain dormant.

In studying the collection of wormseed mustards in our herbarium we recently found that some material collected in 1946 and considered to be a native western species was actually a plant not mentioned in any North American flora. This particular wormseed mustard has since been investigated in the field and found to have extensive distribution in southeastern Ontario. It is a perennial from Eurasia and will require a very different type of attack from our common annual or winter annual plant.

In 1955 it was found that two Asiatic docks were being confused with the curled dock in Western Canada. One of these Asiatic

Author examining plant species.

docks is now abundant in Saskatchewan and Manitoba, much more so than curled dock, and experiments with various chemicals were carried out during the 1956 season to see if special control measures are required.

The weed investigator's task in identification does not end with the correct determination of species. There are variations within individual species that may well be important. Dr. K. Buchholtz at Wisconsin has shown that selected strains of Canada thistle responded as differently to applications of 2,4-D as would different species. Our investigators recently working with Cypress spurge have found it to comprise two types of plants, only one of which produces seed. From the practical standpoint this discovery was of real significance as the sterile plants are ordinarily limited to one slowly spreading roadside patch while the seed-producing plants spread rapidly and have invaded agricultural lands. The seed-producing type forms extensive stands but occurs in only about 15 areas in Canada and concentration of control efforts on these areas should prevent further spread of cypress spurge.

It is tempting to continue with examples of the added precision that correct identification of weed species is offering to the control worker but other facets of weed investigation require attention. An exact knowledge of life history, the series of changes through which a plant passes in the course of its development, is essential to successful control. The information available in the literature is limited and frequently erroneous. Wild carrot is classified as a biennial in most floras and weed manuals. Growing tests at Ottawa show that this plant is also an annual and that in most samples of seed the annuals predominate. Failure in controlling wild carrot may in part be ascribed to its being dealt with as a biennial without thought of its capacity for rapid multiplication.

Weed nursery, Botany and Plant Pathology Division, Ottawa.

Until recent years yellow rocket in Canada was looked upon as an annual. Closer examination of field infestations and of plants in nursery plots at Ottawa has established that yellow rocket behaves as a perennial. It was also found that new shoots developed on all flowering plants in September. This fact coupled with abundant fall germination suggests that yellow rocket can be attacked at the end of the growing season as well as in the spring. Yellow rocket has a remarkable capacity for maturing seed after being cut so that unless removed for silage the cut plants may be a source of further contamination.

The life histories of most of our important weeds are under investigation. A good deal of information is now available on germination behavior. The method used is a simple one; seeds are collected immediately after ripening and placed in flats that are kept outdoors. It is clear that seeds of many weeds germinate soon after ripening, some do not germinate until the following spring, while others germinate equally well in fall and spring. Many species are also grown on in the nursery and records kept of development and inception of flowering and fruiting.

An important part of our weed investigation is to ascertain where the different species of weeds occur in Canada. From reconnaissance surveys embracing all weeds encountered, we now have a remarkable amount of information on the distribution of our weeds. The published data also serve, of course, as an inventory of Canadian weeds. More intensive surveys are carried out to answer specific problems, as for example: for milkweed, during World War II, as a source of floss and rubber; for ragweed, to establish where hay fever sufferers

Left to right: Pasture field heavily infested with yellow rocket in Brome County, Que. A weed surveyor examines a stand of common milkweed in Western Quebec. Cypress spurge of the seed-producing type at Braeside, Ont.

might expect relief; for barberry and buckthorn, intermediate hosts for cereal rusts.

Thorough survey of the persistent perennial weeds in Western Canada in recent years has shown that an alarming situation exists in relation to toadflax, leafy spurge, Russian knapweed and others. Local authorities, particularly in Saskatchewan where the dangers are perhaps the greatest, have made concerted attacks on these weeds since the survey information was made available to them. At present a new type of survey is being tried in Eastern Canada and is proving promising. Complete farms are selected at random at 20-mile intervals and all weeds recorded, together with information on soil type, on the type of crop harboring the weeds and so on.

The findings from these and other closely related basic studies will in time serve to make control methods for weeds more precise and efficient. Weed investigations of this type are of recent origin. Necessarily some years must elapse before weed workers have as valuable a mass of fundamental data as the plant pathologists and entomologists have in their respective fields.

PARKLAND BARLEY

Available for 1957

PARKLAND, the new malting barley developed at the Brandon Experimental Farm (see summer issue RfF) produced excellent yields in the increase fields. Parkland was grown under contract the past summer on 131 private farms in the Prairie Provinces owned by selected seed growers as well as on a few Experimental Farms and Illustration Stations. The rate of seeding was usually 1 bushel per acre or less, although when seeded as a row crop the rate was as low as 8 lb. per acre. Stands were excellent and field after field was estimated to yield 55 to 60 bushels per acre. A number of fields were destroyed by hail and there was some damage in grade due to unfavourable harvesting weather.

Total production available for distribution should exceed 200,000 bushels. Details in connection with the contracts and the distribution to the public are handled by A. B. Masson, who is in charge of the Canada Department of Agriculture Cereal Seed Office in Winnipeg. Mr. Masson is responsible for carrying out Departmental policy on the handling of each new cereal variety produced and released by the Experimental Farms Service in Western Canada.

The policy on Parkland is that it will be distributed in the Prairie Provinces, exclusive of the Peace River area, during the fall and winter of 1956-57. A decision will be made later as to whether or not the variety should be distributed in Eastern Canada. Some of the seed will be sold to registered seed growers as registered seed but a much larger portion will be sold as certified seed to those who do not qualify as registered seed growers of some standing. If registered seed growers do not exhaust the supply by December 1, 1956, then the remainder will be sold on the open market. Each applicant will be able to buy an allotment of 2-10 bushels, the price depending on the grade. Crops grown from certified seed will not be recertifiable. Attempts will be made to see that the seed distributed is kept in Canada for seeding in Canada. Seed for propagation was sold to Minnesota and North Dakota last spring and further quantities may be sold to an Experiment Station in each state requesting a moderate supply. The ban on the export of Parkland barley will remain until the end of the present crop year.

Under this policy all farmers who want seed should be able to get it. It will be sold at a fair price and each applicant will get the same amount. Distribution should be wide enough to prevent undue speculation or advantage. Seed growers will have the opportunity to produce registered seed. The seed trade will have the opportunity to supply the market during the following years, and there should be sizeable lots of registered and commercial seed available for the trade to purchase

* * *

Plant breeding research in Canada is aimed specifically at the advancement of Canadian agriculture but its value does not stop there. An interesting reminder of this fact comes from the Union of South Africa where the variety Regent is making an important contribution to the expanding wheat production of that country. Regent, a product of the Cereal Breeding Laboratory at Winnipeg, is a high yielding, rust resistant variety that produces high quality flour. It is reported to be doing so well in South Africa that many farmers are switching from corn to wheat growing.

Plant Proteins

In

Dairy Calf Starters

In experimental calf pen at Ottawa starter and hay consumption are individually measured, using duplex feed boxes.

RECENT tests have demonstrated the value of an all-plant-protein calf starter. Animal protein has usually been considered necessary in such starters and powdered milk, bloodmeal, meat meal, and fish meal have been popular ingredients. However, starters in which the protein has been furnished entirely from plant sources have given equally good gains under various systems of reduced milk feeding at both Ottawa and Lethbridge. These Experimental Farms tested two slightly different starters as follows:

Ingredient	Ottawa Starter (lb.)	Lethbridge Starter (lb.)
Oat meal or rolled groats	15	..
Ground oats	20	32
Ground barley	10	5
Ground wheat	..	10
Wheat bran	15	10
Linseed oilmeal	10	10
Soybean oilmeal	18	17·5
Alfalfa meal	5	5
Molasses	5	8
Steamed bone meal	1	1
Ground limestone	·5	·5
Salt (plain)	..	1
Salt (cobalt-iodized)	·5	..
	100	100

Irradiated yeast as a source of riboflavin and vitamin D was added to the Ottawa starter at the rate of 22 grams per 100 pounds of the meal. Each 100 pounds of the Lethbridge starter was fortified with 0·05, 0·1 and 1 grams of cobalt-, copper-, and iron-sulphates respectively, and 5 grams of riboflavin, 80,000 international units of vitamin A, and 16,000 I.U. of vitamin D.

At Ottawa the starter was fed to Holstein and Ayrshire calves up to a 4-pound limit daily with a total whole-milk allowance of 350 pounds fed over a 7-week period. The whole milk was fed at 8 pounds daily for the first week, increased to 10 pounds for the third week, and gradually reduced to 4 pounds at the seventh week. At Lethbridge the starter was fed to Holstein calves at a limit of 5 pounds daily along with a whole-milk allowance of 232 pounds per calf. The whole milk was fed at the rate of 10 per cent of body weight for the first 21 days, after which it was gradually discontinued and replaced by warm water over the next 10-day period. Calves on both the Ottawa and Lethbridge starters made above-average daily gains.

Growth rate is carefully checked. Plant protein starter gave as good gains as conventional types containing animal protein.

At Ottawa a second and less complicated starter was developed and under tests there proved equally satisfactory from the standpoint of daily gains. This starter was comprised of the following ingredients:

Ingredients	Amount (lb.)
Oat meal or rolled groats	25
Crushed barley	20
Wheat bran	15
Linseed oilmeal (old process)	32
Molasses	5
Salt (cobalt-iodized)	1
Steamed bone meal	2
	100

Irradiated yeast ..... 22 gm.

During the second, third, and fourth weeks vitamin A concentrate was fed at the rate of 20,000 international units once daily in the milk, and in the meal thereafter until the calves were 8 weeks of age. The calves on this simplified starter were given a limited milk allowance of 66 pounds of whole milk and 34 pounds of skim-milk powder in the form of reconstituted skim milk over a period of 7 weeks.

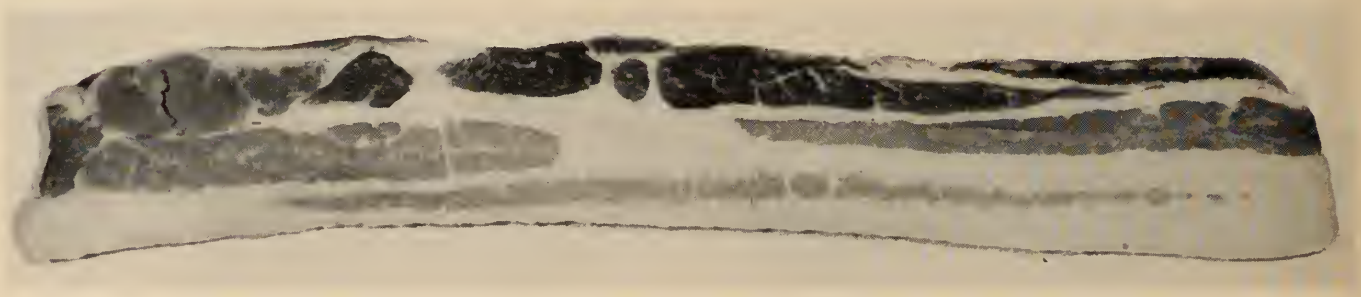
During the first week the calves were fed colostrum and whole milk up to 8 pounds per day. From the seventh to the fourteenth day whole milk was gradually replaced with reconstituted skim milk by exchanging 1 pound of whole milk for 1 pound of prepared skim milk each day. From the beginning of the third week through the sixth week recon-

(Concluded on page 16)

In Toronto, sample with highest "quality rating" was among the leanest. Lean area was 32·4 per cent.

An Experiment in Selling Selected Lean Side Bacon

Charlotte I. Johnston



In Montreal, sample with highest "quality rating" was the leanest. Lean area was 40·6 per cent.

WILL consumer preference for lean bacon set a new trend in classifying and marketing? Would the demand for specially selected bacon justify the extra labor and expense involved? Will the buying public consider the higher price of such a product prohibitive? The Department's Marketing Service is seeking the answers to these questions.

Leanness is one of the chief qualities consumers look for in bacon according to a survey conducted in Toronto and Montreal. This was revealed when about 4,000 persons attending exhibitions in each of the two cities were asked to rate samples of bacon as "good", "fair", or "poor". A close relationship existed between the leanness of the samples and their "quality ratings". In Toronto the sample with the highest "quality rating" was among the leanest; in Montreal it was the leanest.

While it seemed apparent that consumers had definite views on bacon quality standards, it remained to determine whether a uniformly lean product would sell at premium prices. An actual sales trial with bacon selected for leanness shed some light on the matter and more information was gained by questioning customers.

During the course of the experiment it was apparent that many customers attempt to do their own sorting when they buy bacon. Although many shoppers went directly to one brand, about one-third first looked over the display, seeking a well-known brand or one advertised as reduced in price, or making a general comparison of brands.

Two-thirds of the shoppers observed picked up only one brand of bacon, suggesting that they (1) preferred that brand, (2) were attracted by its price, or (3) were hurried. The proportion who picked up only one kind of bacon was highest towards the end of the day when shoppers were on their way home from work.

Opinion polls and actual sales trials suggest a future for selected product

A substantial number of shoppers picked up only one package of bacon but half of those who considered only one brand evidently thought that there were differences between packages of the same brand and examined more than one package. All the customers observed examined an average of four packages per person before making their choice. Presumably many shoppers feel that bacon varies widely in leanness and other qualities that they may be able to judge by scrutiny of the package.

The experiment in selling selected side bacon was carried out during the first half of 1956, in Montreal, by Departmental

officials in co-operation with one meat packing firm and one chain store company. Officials of the Livestock Products Division selected the bacon as it was being packaged in the plant, choosing what appeared to be at least 30 per cent lean with a fair intermixture of fat and lean. The selected bacon comprised 10 to 15 per cent of all the bacon examined. It was sold only in half-pound packages in the usual flat style, with the slices overlapping and labelled "Grade A Lean".

This bacon was displayed in three stores in districts where the clientele was mainly English speaking and of the medium to high income group. In addition to Grade A Lean, six other brands of bacon customarily sold in the stores were on display . The price of Grade A Lean was maintained at six cents per pound above that of the most expensive ungraded brand, which happened to be the top brand of the packing-house furnishing it. During the six-month period becon prices changed considerably. Grade A Lean started at 74 cents a pound, dropped to 68 cents in April and May, and rose to 76 cents by the end of June.

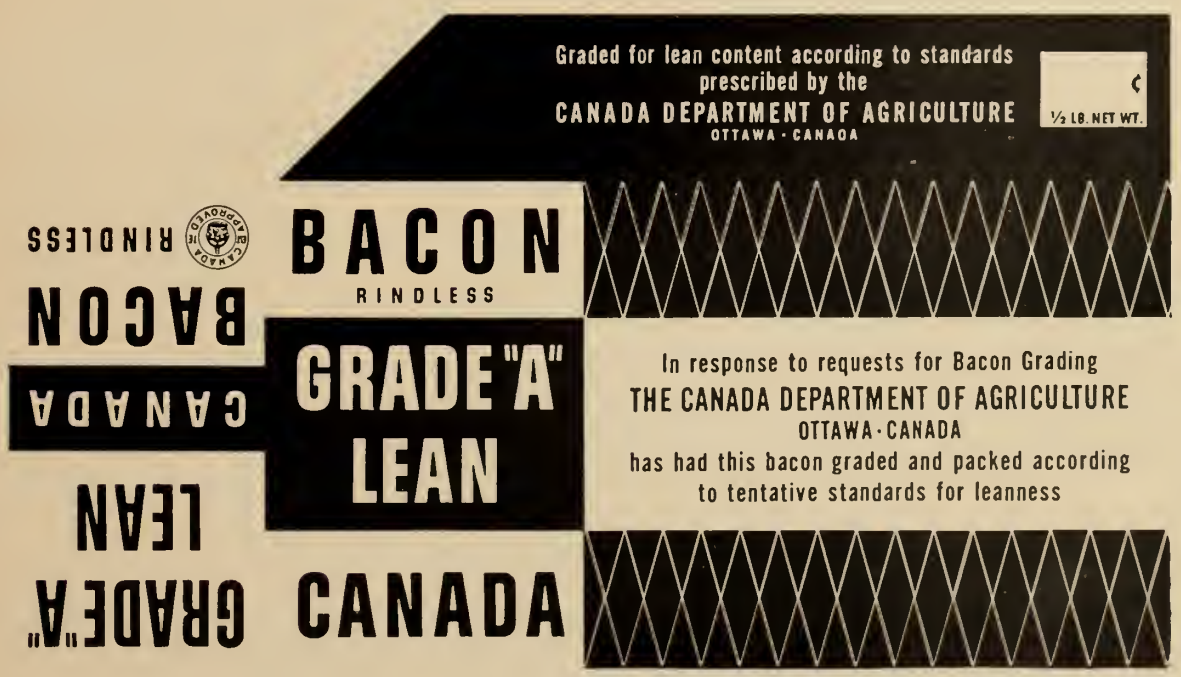
At first, advertising posters called attention to the special bacon but later sales were allowed to take their course without publicity. For the first 12 weeks of the experiment Grade A Lean bacon represented 6 per cent, on the average, of all the side bacon sold in the three stores. In April, for one week, a demonstrator in each store spoke to shoppers, showed open packages of Grade A Lean bacon, and answered questions. Sales during the demonstration period rose to an average of 14 per cent of the total side bacon sold, and thereafter settled at about 9·5 per cent.

Relative sales of Grade A Lean bacon were affected by price. From time to time some brands of bacon were reduced in price, with newspaper advertisements and mass displays. At such times the price of Grade A Lean was 35 to 50 per cent higher than that of the featured brand. On the other hand, in May and June bacon prices showed a rising trend and the competitive position of Grade A Lean became more favorable.

Following the demonstration, questionnaires were sent out to purchasers of the lean bacon. Those who replied were generally heavy users of bacon and their opinions indicated an appreciation of the quality of the selected product and an intention to purchase it again.

During the course of the study consumers opinions revealed considerable dissatisfaction with the present packaging of bacon. The more common suggestions for improvement were: show all of at least one slice; show all of two or more slices; supply a package designed for greater ease in handling contents. Much of the dissatisfaction could be eliminated by the sale of bacon of known quality. Taking the guess work out of bacon buying by offering a more uniformly selected product would apparently be favored by many consumers.

The experiment conducted in Montreal answered in part the question of consumer acceptance of bacon selected on the basis of leanness. Within the limits of the study, the demand for such bacon at substantial price premiums is strong. In fact it appeared to be almost as great as hogs of the type at present marketed in Ontario and Quebec can supply. Side bacon is not a very lean product at best and the quality having 30 per cent lean is definitely limited. Plans are under way to investigate the matter further in other parts of Canada.



Front and back of package of Grade "A" Lean Bacon sold in Montreal, 1956. Actual package was red and white.

Indexing a new strawberry variety to determine the presence of virus infection. A runner from the plant under test is grafted to one on the indicator plant.

New Strawberries Show Promise

FOUR new strawberry varieties particularly promising for Western Ontario have recently been introduced by the Horticulture Division, Central Experimental Farm, Ottawa. The fruit of these varieties is firmer than that of the standard Ontario variety Premier, and they are at least equal to Premier in yield and appearance.

The original crosses were made at Ottawa in 1948 and subsequent testing was carried on there and at the Smithfield Substation as well as at 20 odd points throughout Eastern Canada. Varieties involved in the parentage included Valentine, Sparkle, Fairfax and Claribel. Selected in 1950 from among thousands of seedlings the new varieties were first fruited in the field in 1952 and the same year were indexed for virus infection.

While still known by numbers, Ottawa 481, 483, 484 and 487, some of them will probably be named soon. Plants will be grown by commercial nurserymen in 1957 and the varieties will be available for commercial planting by growers in 1958.

To protect seedling plants from virus infection they are grown in screened frames to exclude disease-carrying aphids and are also sprayed regularly for insect control. When a new variety has been selected as promising for further trial, a nucleus stock of virus-free plants is maintained in similar screened frames.

* * *

Consumer Packaged Sweet Corn Holds Quality in Storage

Researchers at the Horticulture Division, Ottawa, have found that husked sweet corn may be cold stored in consumer packages for as long as two weeks without serious loss of quality. Husked sweet corn in transparent packaging has recently been introduced in Canadian retail stores. The advantage of this method of packaging is that the corn can be readily inspected, insect-infested ears are eliminated, and the corn is ready to cook without any need of husking and desilking. On the other hand, it is difficult to determine to what extent this prepackaged product possesses the desirable sweetness, tenderness and succulence, since the quality decreases rapidly after harvest, due to enzymatic reactions in the kernels. Cold storage retards deterioration but even when stored at a temperature of 32°F. the sugars in sweet corn are converted to starch. The Ottawa scientists were able to hold husked and packaged sweet corn at 33-35°F. for 15 days without excessive deterioration of quality. These studies are being continued.

Tillage Still Best For Wild Oat Control

Control of wild oats in prairie grain fields is a difficult problem. Results of work at the Experimental Farm, Brandon, Man., indicate that while there are good prospects for control by certain new chemicals, the best practical means of control continue to be by the use of suitable tillage practices and of seed free of wild oats. Retiring land to grass at regular intervals is the most effective method of control, but this is not economically possible on the majority of farms. Possibly the most practical means of control is to delay seeding grain on stubble land until after the early spring germination of the wild oats, which can be killed by spring tillage. At Brandon seeding barley on June 10 for three successive years on the same land has almost completely eliminated wild oats, but at the expense of reduced yields of barley.

The wheat stem sawfly is an important pest in the hard spring wheat area of the Great Plains where annual precipitation is about 15 inches per year. Female (above) lays her eggs inside the stem of the host, head downward; each female may lay about 40 eggs.

SAWFLY

Still a Problem for Wheat Growers

N. D. Holmes

DESPITE real progress in lessening the damage caused by wheat stem sawfly, the problem has not yet been completely solved. First records of crop injury in Canada go back to 1896 when the insect was found attacking the crop at Souris, Man. Thirty years later damage estimated at 12 million dollars resulted in Saskatchewan alone while the figure for later losses in Western Canada was much higher.

Although a native insect, its rapid rise in importance as a crop pest resulted from continuous wheat growing on a large scale and from the introduction of strip farming, a measure in turn introduced to control soil drifting. In some areas sawfly damage became so severe that strip farming had to be abandoned.

The planting of trap crops and the use of shallow tillage offered some control but until the introduction in 1946 of the first resistant variety, Rescue, heavy infestations of sawfly could not be controlled. Between 1951 and 1954, Rescue was the second most commonly grown variety of spring wheat in Canada, falling to third place in 1955.

The sawfly causes damage mostly in spring wheat, although it will survive in spring rye and in some varieties of barley. Winter

Left to right: Female uses ovipositor to cut slit in stem when laying her egg. Small white eggs are laid on the inside wall of the stem; probably were laid by three different females as each usually lays only one egg in each stem (wheat shown is Red Bobs, a hollow-stemmed variety). Egg at extreme right was laid in Rescue wheat and is almost ready to hatch; the mandibles appear as two black spots.

Top to bottom: Sawfly larva tunnels inside stem with its biting and chewing mouthparts; wastes are passed out as frass or "sawdust"; larvae destroy each other until only one survives in each stem. Larva of sawfly's main parasite, *Bracon cephi* Gahan, (middle). This parasite destroys about 10 per cent of sawflies each year; adult penetrates stem with ovipositor, paralyses the sawfly larva, and lays an egg. When parasite larva becomes mature, it spins a cocoon (lower left); in midsummer adult parasite chews hole through stem (lower right) and escapes to find other sawfly larvae.

wheat is heavily damaged on occasion, while oats are immune.

Sex Ratio Important

Studies of sawfly life-history have helped to explain its growing importance as a crop pest. In the area north of Lethbridge, only female sawfles were found until 1940 when males began to appear. Eggs laid by virgin females usually produce males; most females are produced from fertilized eggs. It is still possible to select from a large group of sawfles a few virgin females that produce females in successive generations without mating. If all the sawflies were females, they could infest many more stems.

Growing certain varieties of wheat may cause a shift in the ratio of males to females. When different varieties are grown together, the sex ratio of the sawflies differs with the variety. However, the sex ratio can be changed within a variety from mostly females to mostly males by controlling date of infestation. Plants infested earliest produce mostly females; latest infestations produce mostly males. Because the sawflies infest some varieties earlier than others, it appears that differences in time of infestation are largely responsible for the differences in sex ratio associated with varieties. There are more males than females at the beginning of the flight period, so that most females are fertilized and produce mostly females; at the end of the flight period, males are less abundant, so that most females are not fertilized and produce mostly males.

Control by Tillage

Shallow tillage in fall or spring gives some control of the sawfly. The one-way disk is recommended, but only the sawflies in stubs exposed on the surface of the soil are killed and the numbers exposed depend largely on the skill of the operator. A complication arises in shallow tillage in the spring. The larvae withstand extremes of spring and summer weather; they are much more easily killed by weather after they change to prepupae and pupae. If the stubs are exposed before the larvae have changed to prepupae, up to the first week in May, many larvae re-enter the resistant, resting stage because of high temperature and require another winter period before they develop further. Hence, stubs should be exposed between the middle of May and the first week in June. Fall exposure is satisfactory at any time because the larvae are readily killed by winter temperatures.

So far, insecticides have shown little promise. At present, American workers are studying absorption of certain insecticides by the growing plants, but this study has just begun.

When the stem ripens, the surviving sawfly larva cuts the stem (upper inset) at or slightly above ground level. When crops mature late, the adult parasites are able to parasitize sawfly larvae before they can cut the stems and move to the lower end of the stub below ground. Some sawfly larvae, however, are parasitized in the stubs. Sawfly larva (upper left) fills the upper end of the wheat stub with frass, forms a cocoon, and overwinters below ground level. Mature larva (lower inset) is now in a resting stage that requires 90 days at 40°F. before it can develop further. In this stage it is very resistant to unfavorable weather and can live for seven years.

In May and June the larva develops into the prepupal (extreme left) and pupal forms. The adult emerges soon to complete the cycle.

Resistant Varieties

The best control of the sawfly is the use of resistant varieties. Rescue, the pioneer resistant variety, was the outcome of joint efforts of entomologists and plant breeders at Lethbridge and Swift Current. Although very resistant to sawfles, Rescue grades no higher than No. 3 Northern. Another resistant variety, Chinook, was released in 1952. This came from a cross between Thatcher, a high-quality spring wheat, and S-615, one of the parents of Rescue. It is not so resistant as Rescue but has satisfactory milling and baking qualities. Other resistant wheats include Golden Ball, a low-quality durum wheat, and Stewart, a higher-quality durum, but less resistant than Golden Ball.

Present information indicates that all the resistant varieties depend on stem solidness for their resistant quality. The susceptible bread wheats are hollow-stemmed, whereas Rescue, Chinook, Golden Ball, and, to a lesser extent, Stewart, are solid-stemmed, the stems being filled with pith. Solidness in the lower three internodes is of greatest importance. When cloudy, wet conditions occur during late May and June, the resistant varieties become relatively hollow in the lower internodes and lose their resistance. Up to 90 per cent of the stems of Rescue may be cut by the sawfles under these conditions.

Sawflies lay eggs as readily in solid-stemmed varieties as in susceptible ones, but many eggs fail to hatch and many larvae fail to tunnel to the base of the stem. Rescue and Chinook are not recommended in the wetter areas of Western Canada because they are susceptible to leaf and stem rusts. In addition, they are not usually sufficiently solid-stemmed in those areas, apparently because of relatively low sunshine in May and June. Plant breeders are attempting to develop a variety with more stable resistance suitable to these areas.

Canadian research on the sawfly is centered at Lethbridge with the Science Service Laboratory and the Experimental Farm collaborating on the problem. At Lethbridge, the research involves entomologists, plant breeders, cytogeneticists, and chemists. Close co-operation is maintained with American workers and with plant breeders at the Swift Current, Regina, and Scott Experimental Farms.

Annual losses from sawfly attack still run high. Because of this continuing loss, and because experience with other insects and diseases shows that man can only remain ahead of such competitors by steady effort, the study of the sawfly is being continued in an attempt to develop new techniques for its control.

Top to bottom: Occasionally, feeding by the sawfly causes sterile, white heads as shown here with winter wheat. Ordinarily, however, the average loss from larval feeding is about 10 per cent in yield or one or two grades in quality. This damage is exclusive of that caused by the fallen stems. Sawflies emerge from the stubble and move into adjacent strips of wheat, infesting the margins (upper middle) most heavily. Here, the cutting by sawflies was about 100 per cent at the margins and about 60 per cent at the center of the strip. Lower middle shows growing resistant wheat like Rescue (on right) is the best method of reducing sawfly damage. Bottom shows (left to right) when eggs are laid in the pith of Rescue stems, many may die; if egg hatches, larva may die without tunnelling; and if larva does succeed in tunnelling, it stands little chance of surviving in the solid Rescue stem.

MECHANICAL GRAZING

Experiments in Progress

V. S. Logan

Cows relish grass from mobile self-feeder.

MECHANICAL GRAZING, also called zero grazing, involves cutting pasture forage and feeding it to animals in the stable or dry lot. The practice is not new but, with the development of modern harvesting machinery has attracted renewed interest amongst farmers. Most of the information about this system of pasture management has come from experiences on large dairy farms as only limited experimental information is available to date.

Experiments to study the possible advantages of mechanical grazing over other systems of pasture management for dairy cattle have been started at the Experimental Farms at Kapuskasing and Ottawa. At Kapuskasing mechanical grazing is being compared with rotational grazing management while at Ottawa a comparison is being made between mechanical grazing and strip or daily grazing. Observations during the first season indicate that cows may consume more grass when it is cut and hauled to them than when they have to graze it. Aftermath recovery did not appear to be as rapid when mechanically grazed as when grazed by the cows. Equipment and labor requirements for the respective systems are being studied along with other experimental data. At this early stage no definite conclusions can be made.

It would appear that mechanical grazing of pastures might increase costs because of the cost of equipment and labor involved in the daily cutting and feeding of the forage and the cost of removing manure. On the other hand fencing costs could be reduced with mechanical grazing. In addition a considerable saving in forage might be realized since surveys have indicated that cows on pasture waste 40 per cent of the available forage through tramping, contamination by droppings, and lying down. It is also claimed that a more uniform milk flow can be maintained during hot dry periods. With proper timing of cutting sequences it should be possible to provide a continuous supply of grass at the most nutritious stage of growth.

This latter feature is not limited to mechanical grazing since pasture quality can be maintained with strip or daily grazing where cows are moved daily on to an area that provides grazing for one day and are returned to the aftermath when the grass attains sufficient recovery growth. Strip grazing management trials conducted at the Central Experimental Farm, have shown this type of pasture management will increase productivity up to 26 per cent over that of free range grazing. Rotational grazing has also shown varying increases in productivity over free range or continuous grazing.

The experiments in progress should provide a basis for assessing mechanical grazing as to relative influence on productivity and indicate the size of farm unit to which it might be most economically adapted.

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Calf Starters . . . *from p. 9*

stituted skim milk was fed at the rate of 10 pounds per day and during the seventh week milk feeding was discontinued gradually.

Consumption of the starter was encouraged at an early age by making it available to the calves in small quantities at the beginning of the second week. The practice of adding a handful of the starter to the milk during two or three early feedings encouraged the calves to eat the dry meal.

Further details on these experiments will be found in a new bulletin dealing with the feeding and care of the dairy calf, by V. S. Logan and V. J. Miles of the Animal Husbandry Division, Central Experimental Farm. This bulletin should be available for distribution shortly.

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